of Faraday's ice-pail experiment—care should have been taken to make the lines emanating from the charged ball fall normally upon the vessel. The properties of these lines are not dogmatically asserted, but in general are derived, in the usual way, from the inverse square law of force; exception must, however, be made with respect to the lateral pressure exerted by such tubes. In stating that the inverse square law was experimentally verified first by Coulomb the author seems to have forgotten Cavendish, who, fully twelve years earlier, proved that the index cannot differ from two by more than 1/50th part.

We have alluded already to the diagrams; more care than usual has been exercised in regard to these. We are particularly attracted by one showing the lines of force and induction of a horse-shoe magnet. Compared with the usual paltry sketches of these lines this is most excellent. The student ought to be warned, however, that it represents rather an artificial case, since the poles are taken as concentrated at points. In the absence of this warning the student may be puzzled to account for the peculiar configuration of the system of lines shown. Another diagram which is now finding its way into text-books is one (Fig. 354) showing the lines of *electric* force due to a current. Much emphasis is usually placed on the magnetic field, but the electric field is almost entirely ignored. We are glad to see it now beginning to take its proper place. It may be mentioned that if the conductors be taken as infinitely deep, so as to reduce the problem to a two-dimensional one, the lines of force are a family of rectangular hyperbolæ, while the equipotential lines are the orthotomic hyperbolæ.

Several omissions and errors require attention. In the chapter on mechanics there is no definition of *mass*—we are not even told that it is the quantity of matter in a body. It is erroneous to state that electrification and electric currents are forms of energy (p. 22). A hollow soft iron cylinder does not act as a perfect screen to magnetic force for points inside it (p. 65). The proof of the formula for the ballistic galvanometer (p. 282) is imperfect, since it assumes that the current is constant while it flows; whereas it essentially is never so in cases for which this kind of galvanometer is used. A very little change in the proof will put this right. In the formula for simple pendulum or suspended coil the time period should not be written with $\sin\theta/\theta$ in the denominator, since when so written the idea is conveyed that this is the proper form when the difference between $\sin\theta$ and θ is too large to be neglected. In calculating the temperature of a wire when heated by a current the emissivity should not be taken as a constant, for Messrs. Ayrton and Kilgour confirmed Péclet's proof that it depends on the radius; for very thin wires the values go up to many times that quoted, except, of course, in a vacuum. Kelvin's proof of the existence of an E.M.F. *distributed* in a circuit of two metals parts of which are at different temperatures depended on the first law of thermodynamics, and not upon the properties of a Carnot cycle (p. 374). The definition of units is antiquated; those described (p. 515) are now obsolete. On p. 531, in connection with displacement currents the word *displacement* is used on adjacent lines in two senses, with consequent confusion to the meaning. The treatment of the calculation of the propagation of electrodynamic effects (p. 534) which is professedly applicable to the case when the exciting current is travelling along a wire is inapplicable to this case. The display of mathematics in this calculation will convey the erroneous impression of a thorough investigation. The result must be disastrous to a student who is feeling his way toward a knowledge of the subtleties of line-integration round a closed curve. The error arises in part from forgetting that the magnetic induction varies in the direction y as well as in the direction x. Everything is, we believe, put right if the conductor be taken as an infinite plane sheet; the variation which is omitted is in such a case zero.

These few errors are the more unfortunate since we think that the book will prove a very useful one. We frankly think that it has been attempted to put too much into small compass; most sections would be improved by amplification in explanation of principle at the sacrifice of detail. A little excision when this edition is exhausted, a little more attention to logical order and to the development of principles—such suggestions are worth attending to, for the book has the making of a very useful volume.

BUNSEN'S COLLECTED WORKS

Gesammelte Abhandlungen von Robert Bunsen. Edited by Wilhelm Ostwald and Max Bodenstein. Vol. i., pp. cxxvi+535; vol. ii., pp. vi+660; vol. iii., pp. vi+637. (Leipzig: Engelmann; London: Williams and Norgate, 1904.) Price 2*l.* 10*s.* net.

THE appreciative and critical notices of Bunsen and his work which appeared shortly after his death hardly leave room for a review of the volumes before us. In the Chemical Society memorial lecture, which is justly given the place of honour in the prefatory part of the first volume, Sir Henry Roscoe has given a comprehensive survey of Bunsen's work, and has described the personality of the man in such a way as to earn the gratitude of all old Heidelberg students.[1]

In these three stately volumes we have a complete collection of Bunsen's contributions to science and a book that will form part of the permanent literature of chemistry. It is, indeed, a most striking fact that all Bunsen's writings are in their nature permanent scientific literature, a fact that well deserves pondering at the present time. He made some mistakes, he advanced some conclusions now untenable, but his writings are of faithful observations, careful experiments, laboratory methods. Of speculative theory there is nothing, and of strictly polemical writing also nothing. The books that are included in his writings are accounts of methods of doing things that he him-

[1] An account of Bunsen's scientific work was given by Sir Henry Roscoe in NATURE of April 28, 1881 (vol. xxiii. p. 597), as a contribution to our series of "Scientific Worthies."—EDITOR.

self devised—gas analysis, mineral water analysis, flame reactions. It is not easy to describe Bunsen's relation to chemical science. He was a perfect type of "Naturforscher," a word for which there is hardly an English equivalent. He lived in his laboratory, ever absorbed, he seemed, in finding his way through natural problems, like a navigator always on the bridge sailing in an unknown archipelago. His writings are hardly more than his log, and his lectures were the narratives of his own particular voyage in the region called chemistry. To a listener who had a fair knowledge of chemistry and its literature it seemed as if there were no part of inorganic chemistry which Bunsen had not made in some way his own. In the laboratory it was the same; from the making of a borax bead to the execution of the most complicated analysis there was the Bunsen method of doing things. Spectroscopy, gas analysis, and electrolytic chemistry for long seemed wholly his. No chemist had a broader or more philosophical outlook than he; on the one hand he had a profound distrust of theory that went in advance of experiment, and on the other hand he despised all kinds of aimless or recipe work. Of the periodic classification of the elements he said at one time, "Ja, solche Regelmässigkeiten findet man in den Börsenblättern"; of a well known standard work on analysis he said "Koch-buch!" and indignantly ordered its removal. What a memorable experience it was for a student to work with Bunsen through the Russian Mint residues! The innumerable devices of his own, the "nursing" operations at different stages, the tales of his earlier efforts and disasters, the eager hope "vielleicht steckt etwas neues darin," the dry assurance "ja, alle Wochen werden ein Paar neue Platinmetalle entdeckt"—all these things come to mind to recall the image of a man in whom the art of a past master was combined with the artlessness of a child.

It is impossible to estimate the influence of such a man; but in the volumes which it is the object of this notice to commend, it is possible to read the record of his work and to catch something of the spirit which animated the worker.

The collected works are published under the auspices of the German Bunsen Society for Applied Physical Chemistry, and are edited by Prof. Ostwald and Dr. Bodenstein. We are therefore assured that the task has been performed with pious care and with fulness of knowledge. The original intention of publishing a biography of Bunsen had to be abandoned owing to his express order, so characteristic, that his literary remains should be destroyed. He also desired that from his own letters in the possession of others nothing of a personal character should be published. The gap thus left is probably not so great as might be imagined, and one feels, after reading the prefatory memoirs by Sir Henry Roscoe, Dr. Rathke, and Prof. Ostwald himself, that we have probably all we really need to know. "Bunsen stories" were doubtless good to those who knew him, but to those who did not they were apt to be like most tales of university dons, and the collection which has been privately published seems rather trivial, and jars somewhat on the ears of the faithful. But the collection of his writings makes a noble monument, and the thanks of all chemists are due to the Bunsen Society and to the two editors who have undertaken the laborious task and have executed it so well.

ARTHUR SMITHELLS.

OUR BOOK SHELF.

The Practical Study of Malaria and other Blood Parasites. By Dr. J. W. W. Stephens and S. R. Christophers. 2nd Revised Edition. Pp. iii+396 and xliv. (London: Published for the University Press of Liverpool by Williams and Norgate, 1904.) Price 12*s.* 6*d.* net.

THIS volume gives a very full and complete account of the practical methods employed in the study of malaria and kindred protozoan diseases of man and animals. The book being intended primarily for the use of medical men in the tropics, who may be far from any laboratory, abounds in practical hints and suggestions which will enable good work to be accomplished with a minimum of apparatus, &c.

The methods of making and staining blood-films are given very fully, and the appearances of normal blood and of the various malaria parasites carefully described. In connection with malaria, the methods of catching, breeding, keeping, and feeding mosquitoes for purposes of malaria study receive considerable attention, and the life-history of the mosquito and the characters of a number of the more important species have no less than 200 pages devoted to them. Chapters then follow on the clinical and epidemiological study of malaria, and finally the hæmamœbidæ, trypanosomes, spirochætes, and filariæ are considered. This entails descriptions of the anatomy and classification of the chief species of ticks, fleas, tsetse and other biting flies, and a mass of detail is thus brought together in a form required by the investigator for which he otherwise would have to search in many scattered papers and works of natural history. In this respect the book will be of great value in laboratories of medical protozoology and the like. There are few points to which exception can be taken, for the book is the outcome of the authors' own experience on the subjects of which they write. It may be doubted, however, if methylated spirit can take the place of methyl alcohol for making up the Leishman blood-stain, and the authors' view that blackwater fever is malaria plus hæmoglobinuria excited by chill, quinine, or other simple cause is open to question.

The book can be recommended as a most valuable guide, and the numerous illustrations, diagrammatic though many of them are, enhance its usefulness.

R. T. HEWLETT.

Pictures from Nature. By Richard and Cherry Kearton. Portfolio of fifteen Rembrandt photogravures. Size 15in. × 11in. (London: Cassell and Co., Ltd.) Price 10*s.* 6*d.* net.

THE remarkable photographs taken by the Brothers Kearton of animal life in many aspects have often been described in these columns in terms of the highest praise. The fifteen pictures of birds and other animals, among their natural surroundings, reproduced for the present portfolio, represent the high-water mark of faithful portraiture in natural history.

The plates include the following subjects:—Black throated diver, kittiwakes at home, leverets in their form, kingfisher waiting for its prey, squirrel, puffins